

What is claimed is:

1           1.     A semiconductor wafer cleaning apparatus comprising:  
2                 a loading unit having a cassette loaded thereon, a plurality of semiconductor  
3                 wafers being mounted on the cassette;  
4                 a moving mechanism that extracts the semiconductor wafers mounted on the  
5                 cassette of the loading unit and moves the extracted semiconductor wafers into a  
6                 loader spaced apart from the loading unit;  
7                 an inner bath spaced apart from the loader, in which the semiconductor wafers  
8                 are cleaned with a cleaning solution;  
9                 a marangoni dryer including a hood, that moves the semiconductor wafers from  
10                the loader into the inner bath, the marangoni dryer movable in  $\pm X$ -,  $\pm Y$ -, and  $\pm Z$ -  
11                directions to be tightly sealed to the inner bath; and  
12                a knife that supports the semiconductor wafers loaded into the inner bath at a  
13                lower portion of the inner bath, and moves the semiconductor wafers up and down.

1           2.     The semiconductor wafer cleaning apparatus according to claim 1,  
2                 wherein the moving mechanism comprises:  
3                 a pad that extracts the semiconductor wafers from the cassette;  
4                 a first moving element including a revolving body, that rotates and thereby  
5                 elevates the extracted semiconductor wafers extracted by the pad; and  
6                 a second moving element that moves the semiconductor wafers rotated upward  
7                 by the first moving element into a loader.

1           3.     The semiconductor wafer cleaning apparatus according to claim 2,  
2                 wherein the second moving element comprises:  
3                 a clutch movable in the  $\pm X$ -,  $\pm Y$ -, and  $\pm Z$ -directions, that picks up the  
4                 semiconductor wafers rotated and elevated by the first moving element; and

5 rails movable in the  $\pm X$ -,  $\pm Y$ -, and  $\pm Z$ -directions, that move the semiconductor  
6 wafers picked-up by the clutch into the loader.

1 4. The semiconductor wafer cleaning apparatus according to claim 1,  
2 wherein the loader includes a pusher that raises and lowers the mounted  
3 semiconductor wafers so that the marangoni dryer picks up the semiconductor wafers.

1 5. The semiconductor wafer cleaning apparatus according to claim 1,  
2 wherein the hood of the marangoni dryer includes slots and a locking unit that hold the  
3 semiconductor wafers, the marangoni dryer further comprising:

4 a drying solution supply plate having a plurality of holes so that the drying  
5 solution is uniformly sprayed onto the mounted semiconductor wafers in the hood; and  
6 a drying solution supply nozzle installed on the drying solution supply plate.

1 6. The semiconductor wafer cleaning apparatus according to claim 5,  
2 wherein the drying solution comprises isopropyl alcohol.

1 7. The semiconductor wafer cleaning apparatus according to claim 1,  
2 wherein the inner bath comprises:

3 recess portions formed in both sidewalls of the inner bath; and  
4 outer baths installed at both sides of the inner bath, aligned with the recess  
5 portions.

1 8. The semiconductor wafer cleaning apparatus according to claim 7, further  
2 comprising exhaust lines installed at rear walls of the outer baths, that uniformly  
3 exhaust the outer baths.

1           9.     The semiconductor wafer cleaning apparatus according to claim 1,  
2 wherein the cleaning solution comprises a chemical solution or deionized water.

1           10.    A method of cleaning a semiconductor wafer comprising:  
2           loading a cassette into a loading unit, the cassette holding a plurality of  
3 semiconductor wafers;  
4           extracting the semiconductor wafers held on the cassette of the loading unit;  
5           moving the extracted semiconductor wafers into a loader spaced apart from the  
6 loading unit;  
7           mounting the semiconductor wafers from the loader into a marangoni dryer;  
8           moving the marangoni dryer including the semiconductor wafers mounted  
9 therein, into an inner bath spaced apart from the loader;  
10          moving the semiconductor wafers from the marangoni dryer into the inner bath;  
11          cleaning the semiconductor wafers in the inner bath with a cleaning solution;  
12          lowering the marangoni dryer to be closely adhered and sealed to the inner bath;  
13 and  
14          lifting the semiconductor wafers from the inner bath containing the cleaning  
15 solution while drying solution fumes are sprayed from a top of the marangoni dryer, so  
16 that the cleaning solution is removed from the semiconductor wafers using a difference  
17 in surface tension between the drying solution and the cleaning solution.

1           11.    The method according to claim 10, wherein said mounting comprises  
2 moving the loader with a pusher installed under the loader, to move the semiconductor  
3 wafers into the marangoni dryer for mounting.

1           12.    The method according to claim 10, wherein said lifting comprises lifting  
2 the semiconductor wafers with a knife installed in a bottom portion of the inner bath.

1           13.    The method according to claim 10, wherein the cleaning solution  
2 comprises a chemical solution or de-ionized water, and the drying solution comprises  
3 isopropyl alcohol.

1           14.    The method according to claim 13, wherein nitrogen is also sprayed from  
2 the top of the marangoni dryer during said lifting.

1           15.    A method of cleaning a semiconductor wafer comprising:  
2 loading a cassette into a loading unit, the cassette holding a plurality of  
3 semiconductor wafers;  
4 extracting the semiconductor wafers held on the cassette of the loading unit;  
5 moving the extracted semiconductor wafers into a loader spaced apart from the  
6 loading unit;  
7 mounting the semiconductor wafers from the loader into a marangoni dryer;  
8 moving the marangoni dryer including the semiconductor wafers mounted  
9 therein, into an inner bath spaced apart from the loader;  
10 moving the semiconductor wafers from the marangoni dryer into the inner bath;  
11 cleaning the semiconductor wafers in the inner bath with a cleaning solution;  
12 lowering the marangoni dryer to be closely adhered and sealed to the inner bath;  
13 and  
14 slowly draining the cleaning solution from the inner bath while drying solution  
15 fumes are sprayed from a top of the marangoni dryer, so that the cleaning solution is  
16 removed from the semiconductor wafers using a difference in surface tension between  
17 the drying solution and the cleaning solution.

1           16.    The method according to claim 15, wherein said slowly draining comprises  
2 uniformly exhausting the inner bath via an exhaust line installed in outer baths mounted  
3 at both sides of the inner bath.

1           17.    The method according to claim 15, wherein the cleaning solution  
2 comprises a chemical solution or de-ionized water, and the drying solution comprises  
3 isopropyl alcohol.

1           18.    The method according to claim 17, wherein nitrogen is also sprayed from  
2 the top of the marangoni dryer during said draining.

1           19.    A semiconductor wafer cleaning apparatus comprising:  
2 a bath that contains a cleaning solution;  
3 a marangoni dryer including a hood, the marangoni dryer being movable to pick  
4 up semiconductor wafers loaded in a cassette and being movable to transport the  
5 picked up semiconductor wafers to the bath and so that the hood is tightly sealed to the  
6 bath; and  
7 a supply mechanism that uniformly provides a drying solution to the  
8 semiconductor wafers from an upper portion of the hood, when the marangoni dryer is  
9 tightly sealed to the bath.

1           20.    The semiconductor wafer cleaning apparatus of claim 19, wherein the  
2 cleaning solution comprises a chemical solution or deionized water, and the drying  
3 solution comprises isopropyl alcohol.